GAUGE CALIBRATION

This invention relates to gauge calibration. In particular, but not exclusively, it relates to the calibration of gauges for measuring the weight/thickness of coatings such as lacquer applied to metals such as

5   tinplate used in the can making trade.

Capacitance based film weight gauges are known which are used for the measurement of dry film "weight". Whilst measurements taken by such known gauges are accurate, their calibration and stability over time is poor. In

10   these gauges, a panel of known film weight is used to programme a selected channel to give the correct film weight when a measurement is taken. The panel allows the meter to be programmed with a factor K which relates the capacitance measured by the gauge to the film weight.

15   This factor is a function of the dielectric constant of the lacquer such that the film weight is computed from the product of the capacitance and this factor K. The value obtained on the gauge is a linear correction of the capacitance measured and allows the measurement of the

20   film weight of this particular lacquer on production sheet metal.

One major problem with this known system is that recalibration is time consuming and needs to be carried out independently for each channel of the gauge,

25   typically 40 or more channels being used. As a panel is required for checking each of the 40+ channels which are programmed, this inevitably leads to infrequent recalibration. These panels are also not produced to a common, traceable standard and are prone to damage and

30   consequent inaccuracy through repeated usage.

A further problem with known gauges is that there is
no way of quantifying either the condition of the tip of
the probe which is used together with the gauge, or any
contamination of the probe tip.

5   This invention seeks to provide a method of
calibrating a film thickness gauge which is a single
operation and which also compensates for any
deterioration in probe tip condition.

        According to the present invention, there is
10   provided a method of calibrating a gauge for measuring
film thickness/weight, the gauge including a probe, the
method comprising the steps of:

        (a) determining a universal calibration constant for
a material from a first standard having a known
15   capacitance and weight;

        (b) measuring the weight of a second standard of
known weight;

        (c) calculating the difference between the measured
weight and the known weight of the second standard to
20   obtain a calibration variable; and

        either (c) resetting the calibration variable so
that the measured weight of the second standard
corresponds to its known weight, thereby recalibrating
the gauge, or (d) cleaning the tip of the probe.

25   The Applicant has recognised that the factor K of
known systems is not a true constant. In practice, this
factor K comprises one true universal calibration
constant comprising $K_{lacquer\ dielectric}$ and a calibration
variable $K_{probe\ tip}$ which compensates for short term changes
30   in the condition of the probe tip. Prior to this

invention, degradation of probe tip was considered to be
adequately compensated for by cleaning of the probe tip
and was therefore combined with the calibration constant
as a single factor K for measurement purposes.

5   The calibration constant is a factor derived for
each lacquer which relates the dielectric of the lacquer
to that of a standard material used for calibration. Once
determined, the value is fixed and is a universal
calibration constant which is the same for this material

10   in every plant, independent of location. This standard
therefore does not require storage on site except as a
constant value "stored" in a computer database or
programme, for example. There is thus no requirement to
hold a library of standards on site, as required by prior

15   art gauges. Furthermore, as this standard is a true
constant, the value of the standard does not require
rechecking when each film weight measurement is taken.

The calibration variable $K_{probe\ tip}$ is determined
before each sheet is measured by checking the value

20   obtained from a stable and robust standard which is held
with the gauge in the factory or on site. In one
preferred embodiment of the invention, this standard is a
laminate and may ideally include a layer of polyethylene
terephthalate (PET) which is robust and has similar

25   electrical properties to conventional coatings. Trials
have also shown that the level of correlation of laminate
standards performance with a range of lacquers is
extremely high.

Clearly the use of a calibration variable is better

30   able to correct for any probe tip degradation than the

visual inspection of prior art gauges. This single robust
second standard is held on site and enables regular
calibration of the gauge and/or before each film weight
measurement, thus maximising the accuracy of the gauge.

5   Recalibration of the gauge is carried out when the
specified value of the second standard cannot be achieved
by cleaning of the probe tip.

Preferably the invention further comprises the steps
of (e) placing a capacitance of known value in series

10   with the gauge; and (f) measuring the capacitance of a
circuit formed by the gauge and known capacitor to obtain
an indication of the degree of deterioration of the probe
tip and any need for resetting the value of the
calibration variable.

15   Known gauges have no means of recording
deterioration of the probe tip over an extended period of
time and so are unable to detect when a probe tip might
need changing. By using a fixed capacitor to check the
reading on the gauge independently of the condition of

20   the probe tip, cumulative recalibrations can be tracked.
In this instance, the gauge measurement is directly
proportional to the value of the calibration variable as
the capacitance and calibration constant are fixed. The
calibration variable is, in turn, related to probe tip

25   condition.

By using a panel comprising a known standard film to
recalibrate the gauge and by checking the probe tip for
degradation using a standard capacitor, the method of the
present invention provides a system which enables one-

30   off calibration for films and lacquers on-site, in

factory environments or in the laboratory, as required.
By checking for probe tip damage, calibration for drift
in readings due to probe condition is applicable to all
readings and can be set "globally" on a single channel
5   using a single standard.

        Example 1
        The lacquer calibration constant for a lacquered
panel was determined from panel standards as 0.233 and
10   this value was saved in a computer data base. The
calibration variable of a laminate standard was
determined from master standards as 75. Probe tip
condition was checked by use of a capacitor placed in
series with the gauge. Capacitance readings for a film
15   were converted to film weight and multiplied by 0.233 to
give actual film weights. Resultant data was stored.
        Any change observed in the lacquer standard was also
observed in the laminate standard. Any changes were found
to be due to probe tip contamination rather than drift in
20   lacquer properties. By referring to a measurement of pure
capacitance, any degradation of the probe tip was
assessed and the need for replacement probe tip rather
than continued recalibration was determined.